

Description

TECHNICAL FIELD

In the manufacture of all kinds of sheet-like articles or articles having sheet-like portions it is commonplace to stiffen the article, or portions of the articles as the case may be, by means of ribs applied to one or both sides thereof. The present invention relates to the formation of such stiffening ribs in particular to the formation of hollow stiffening ribs composed of a hard setting synthetic plastics material such as polyester resins, epoxy resins, vinyl esters or the like, preferably with reinforcing fibres, for example, glass, carbon, plastic or natural fibres, embedded in the resinous or plastics material.

Articles of fibre reinforced plastics material, including hollow stiffening ribs thereof, may be made by "laying up", that is to say by placing a layer of woven or non-woven reinforcing fibres upon a mould surface and then painting or impregnating that layer with the hard-setting plastics material while in a liquid or pasty state and subsequently allowing or causing the plastics to set. Alternatively, a mixture of unset resin and short fibres may be applied to the mould surface in one operation.

BACKGROUND ART

Hitherto, hollow stiffening ribs of the kind under discussion have been made by applying bulky, low strength, ropes of paper, wooden slats or other cheap former elements, to one side of a sheet-like article or article portion and subsequently covering those elements with a layer of the settable rib material which sets and becomes bonded to the main body of the sheet intermediate the elements, but is held away from the main body by the elements so constituting filled or hollow ribs.

While the above described method of providing stiffening ribs is generally satisfactory, it is not entirely so, primarily because of the difficulty of holding the former elements in position relative to each other, especially if it is desired to run stiffening ribs in two directions substantially at right angles to each other. These other methods substantially increase the weight and/or cost of the product.

One method of overcoming these problems has been to use a former comprising a foraminous sheet in which the areas between adjacent holes comprise a grid of spaced apart, arch-sectioned longitudinal members and spaced-apart, arch-sectioned transverse members and said members being integrally united at the respective intersection points.

Though this method provides a great improvement over previous arrangements it still has several disadvantages. In order to produce the arch-sectioned members used in this known method the material used to make the former must be substantially rigid and have sufficient mechanical strength to support a layer of settable plastics material. A distinct disadvantage of known formers, when applied to the production of shaped articles having complex curves, is their lack of flexibility and inability to follow the complex curves without losing or distorting the original designed shape and losing their effectiveness.

GB-1,104,490 discloses a former comprising a sheet having an array of holes between which the sheet is shaped to form a continuous raised area.

The present invention seeks to overcome or at least ameliorate these disadvantages by providing a former which is flexible and can be made from thin light material that will maintain its designed shape whilst contorting to a simple or compound curve.

According to the present invention there is provided a former for supporting a layer of settable plastics material while it sets into hollow reinforcing ribs bonded to a laid up article of fibre reinforced plastics material during manufacture of said article, comprising a foraminous sheet wherein the region of the sheet between each pair of neighbouring holes is elevated above the plane in which the rims of the holes are disposed characterised in that each elevated region comprises one or more upstanding formations joined to one another by a flexible web.

For preference the upstanding formations are provided with generally level lands lying parallel to the plane of the sheet. Preferably, the upstanding formations are joined at their bases but may be connected at any level between the formations. For preference, said land is provided with a rigidifying formation. Preferably, the rigidifying formation comprises one or more depressions or patterns of depressions formed in the surface of said land, said depressions arranged to resist flexing of the land transverse thereto.

BRIEF DESCRIPTION OF DRAWINGS

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a plan view of a former according to one embodiment of the invention;

Figure 2 is a section view taken on line 2 - 2 of Figure 1;

Figure 3 is a section view taken on 3 - 3 of Figure 1;

Figure 4 is an enlarged section view, similar to Figure 2, with the fibreglass laid up;
 Figure 5 is an enlarged section view, similar to Figure 3, with the fibreglass laid up;
 Figure 6 is an enlarged section view, similar to Figure 5, with the further planar layer of fibreglass applied to a form a sheet;
 Figure 7 is a plan view of the filler element shown in Figure 6; and
 Figure 8 is a perspective view of the former of Figure 1, illustrating the ability to assume complex curves.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Figures 1 to 3, the former according to this embodiment a foraminous sheet 5 formed from an inexpensive mouldable material such as paper mache, fibreglass or plastics material. In this example, the former is converted from a sheet 5 of plastics or film material.

The sheet 5 is pierced by a plurality of holes 6 arranged in an orderly array of intersecting rows and the material of the sheet 5 is formed into a one or more upstanding formations 7 having substantially planar upper surfaces forming lands 8. Each formation 7 is joined to adjacent formations at their bases 9 by a flexible web 10.

In order to prevent inward deformation of the lands 8 during the laying up process, the lands 8 are rigidified by a pattern of depressions or grooves 11 formed in the surface of the sheet. The grooves 11 have been found to resist transverse bending or flexing and thus effectively rigidify the lands 8 while still allowing the former to assume complex forming shapes as best shown in Figure 8.

The patterns applied to the lands are preferably symmetrical and repeated so to allow for nesting and overlapping of sheets. This assists in joining fixed sized sheets into any sized sheet required. In joining the former sheets 5 the former sheets may be overlapped at the edges by nesting one row of formations 7 within the upstanding formations on the mating edge of a further sheet. The sheets may equally be merely abutted edge to edge and the laying up process used to form a permanent joint.

As best shown in Figures 4 and 5, when the former is to be used it may be applied to sheet 15 which may be of any suitable material, including fibre reinforced synthetic resin, with the rims of the holes 6 in contact with the sheet 15 and the upstanding formations 7 projecting upwardly therefrom.

A layer of fibre reinforced synthetic resin 16 may then be applied to the exposed surface so as to contact and bond with the sheet 15 through the

holes 6. Once these parts of layer 16 which are supported by the formations 7 set, they constitute stiffening ribs on the original sheet 15.

If the former is to be applied to a sheet of sharp or complex curvature, the provision of flexible webs 10 enables the former to be bent as required to follow the curved surface. (See figure 8).

The plastics layers supported or formed on the former according to the invention may also be sandwiched between the sheet 15 and a further sheet 17 as shown in figure 8 to constitute a light weight, rigidifying filling or core for composite panel structures or the like. This further sheet 17 may be preformed of fibre glass reinforced plastic or other sheet material and bonded to sheet 16 prior to sheet 16 becoming set or post laying up sheet 17 in the conventional manner.

When applying the further sheet 17 to the structure it may be desirable to prevent sagging or deformation of the sheet into the depression formed by laying up into hole areas 6. To prevent this sagging a filler element 18 may be placed into the depression so as to support the sheet 17.

In this embodiment, the filler element 18 is of stool-like construction, however, any suitable filling element may be used. The filler element of this embodiment may be formed during production of the sheet of the intended location of the holes 6. When the holes are cut out the the filling element is removed. This procedure avoids any unnecessary wastage of material. Further the stool element 19 may be provided with a flat lid 20 which sits on the top of the stool element prevent entry of material into the hollow legs 21 of the stool element.

Materials other than those described above may be used, it being appreciated that the former itself requires very little strength, merely enough to support a thin layer of resinous material, and, even then, only for so long as it is necessary for the resin of that layer to set.

Further, it will be appreciated that the holes in the foraminous sheet may be irregularly or randomly disposed and may be of differing shapes and/or sizes.

It will be apparent to those skilled in the art, that further embodiments of the invention are possible and the invention is not limited to the specific examples described.

Claims

1. A former for supporting a layer of settable plastics material while it sets into hollow reinforcing ribs bonded to a laid up article of fibre reinforced plastics material during manufacture of said article, comprising a foraminous



Figure 4 is an enlarged section view, similar to Figure 2, with the fibreglass laid up;

Figure 5 is an enlarged section view, similar to Figure 3, with the fibreglass laid up;

Figure 6 is an enlarged section view, similar to Figure 5, with the further planar layer of fibreglass applied to a form a sheet;

Figure 7 is a plan view of the filler element shown in Figure 6; and

Figure 8 is a perspective view of the former of Figure 1, illustrating the ability to assume complex curves.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Figures 1 to 3, the former according to this embodiment a foraminous sheet 5 formed from an inexpensive mouldable material such as paper mache, fibreglass or plastics material. In this example, the former is converted from a sheet 5 of plastics or film material.

The sheet 5 is pierced by a plurality of holes 6 arranged in an orderly array of intersecting rows and the material of the sheet 5 is formed into a one or more upstanding formations 7 having substantially planar upper surfaces forming lands 8. Each formation 7 is joined to adjacent formations at their bases 9 by a flexible web 10.

In order to prevent inward deformation of the lands 8 during the laying up process, the lands 8 are rigidified by a pattern of depressions or grooves 11 formed in the surface of the sheet. The grooves 11 have been found to resist transverse bending or flexing and thus effectively rigidify the lands 8 while still allowing the former to assume complex forming shapes as best shown in Figure 8.

The patterns applied to the lands are preferably symmetrical and repeated so to allow for nesting and overlapping of sheets. This assists in joining fixed sized sheets into any sized sheet required. In joining the former sheets 5 the former sheets may be overlapped at the edges by nesting one row of formations 7 within the upstanding formations on the mating edge of a further sheet. The sheets may equally be merely abutted edge to edge and the laying up process used to form a permanent joint.

As best shown in Figures 4 and 5, when the former is to be used it may be applied to sheet 15 which may be of any suitable material, including fibre reinforced synthetic resin, with the rims of the holes 6 in contact with the sheet 15 and the upstanding formations 7 projecting upwardly therefrom.

A layer of fibre reinforced synthetic resin 16 may then be applied to the exposed surface so as to contact and bond with the sheet 15 through the

holes 6. Once these parts of layer 16 which are supported by the formations 7 set, they constitute stiffening ribs on the original sheet 15.

If the former is to be applied to a sheet of sharp or complex curvature, the provision of flexible webs 10 enables the former to be bent as required to follow the curved surface. (See figure 8).

The plastics layers supported or formed on the former according to the invention may also be sandwiched between the sheet 15 and a further sheet 17 as shown in figure 6 to constitute a light weight, rigidifying filling or core for composite panel structures or the like. This further sheet 17 may be preformed of fibre glass reinforced plastic or other sheet material and bonded to sheet 16 prior to sheet 16 becoming set or post laying up sheet 17 in the conventional manner.

When applying the further sheet 17 to the structure it may be desirable to prevent sagging or deformation of the sheet into the depression formed by laying up into hole areas 6. To prevent this sagging a filler element 18 may be placed into the depression so as to support the sheet 17.

In this embodiment, the filler element 18 is of stool-like construction, however, any suitable filling element may be used. The filler element of this embodiment may be formed during production of the sheet of the intended location of the holes 6. When the holes are cut out the the filling element is removed. This procedure avoids any unnecessary wastage of material. Further the stool element 19 may be provided with a flat lid 20 which sits on the top of the stool element prevent entry of material into the hollow legs 21 of the stool element.

Materials other than those described above may be used, it being appreciated that the former itself requires very little strength, merely enough to support a thin layer of resinous material, and, even then, only for so long as it is necessary for the resin of that layer to set.

Further, it will be appreciated that the holes in the foraminous sheet may be irregularly or randomly disposed and may be of differing shapes and/or sizes.

It will be apparent to those skilled in the art, that further embodiments of the invention are possible and the invention is not limited to the specific examples described.

Claims

1. A former for supporting a layer of settable plastics material while it sets into hollow reinforcing ribs bonded to a laid up article of fibre reinforced plastics material during manufacture of said article, comprising a foraminous



sheet (5) wherein the region of the sheet between each pair of neighbouring holes is elevated above the plane in which the rims of the holes (6) are disposed characterised in that each elevated region comprises one or more upstanding formations (7) joined to one another by a flexible web (10).

2. A former according to claim 1 wherein the upstanding formations are provided with generally level lands (8) lying parallel to the plane of the sheet. 10
3. A former according to claim 2 wherein the upstanding formations are joined at their bases (9). 15
4. A former according to claim 2 or 3 wherein one or more of said lands is provided with a rigidifying formation (11). 20
5. A former according to claim 4 wherein said rigidifying formation (11) comprises one or more depressions or patterns of depressions formed in the surface of said land, said depressions arranged to resist flexing of the land transverse thereto. 25
6. A former according to claim 5 wherein said patterns applied to the lands are symmetrical and repeated so to allow for nesting and overlapping of sheets. 30
7. A former according to claim 5 wherein said depressions are grooves in the surface of the land. 35
8. A former according to claim 1 wherein said holes are arranged in an array of rows substantially parallel to the edges of the sheet. 40
9. A manufactured article incorporating a former according to any one of the preceding claims.
10. An article according to claim 9 wherein the former is applied to a sheet (15) of material with the rims of the holes in contact with said sheet of material and the upstanding formations projecting upwardly therefrom, a layer of fibre reinforced synthetic resin (16) being applied to an exposed surface of said former so as to contact and bond with said sheet of material through said holes. 45
11. An article according to claim 10 including a further sheet of material (17) bonded to upstanding areas of said fibre reinforced synthetic resin layer. 50

Patentansprüche

1. Schablone zum Tragen einer Schicht aus aushärtbarem Kunststoffmaterial, während diese zu hohlen Verstärkungsrippen erstarrt, die mit einem aufgelegten Artikel aus glasfaserverstärktem Kunststoffmaterial während dessen Herstellung verbunden werden, mit einem mit Öffnungen versehenen Bogen (5), wobei der Bereich des Bogens zwischen jedem Paar von benachbarten Öffnungen über die Ebene erhöht ist, in der sich die Ränder der Öffnungen (6) befinden, dadurch gekennzeichnet, daß jeder erhöhte Bereich eine oder mehrere stehende Gebilde (7) aufweist, die durch einen flexiblen Grat (10) miteinander verbunden sind.
2. Schablone nach Anspruch 1, wobei die stehenden Gebilde mit im allgemeinen horizontalen Stegen (8) versehen sind, die parallel zu der Ebene des Bogens liegen.
3. Schablone nach Anspruch 2, wobei die stehenden Gebilde an ihren Böden (9) miteinander verbunden sind.
4. Schablone nach Anspruch 2 oder 3, wobei eine oder mehrere der Stege mit einem Versteifungsgebilde (11) versehen ist.
5. Schablone nach Anspruch 4, wobei das Versteifungsgebilde (11) einen oder mehrere Vertiefungen oder Muster aus Vertiefungen umfaßt, die in der Oberfläche des Stegs ausgebildet sind, wobei die Vertiefungen angeordnet sind, um dem Biegen des Stegs quer dazu standzuhalten.
6. Schablone nach Anspruch 5, wobei die Muster, die auf den Stegen verwendet sind, symmetrisch sind und sich wiederholen, um so eine Verschachtelung und ein Überlappen von Bögen zu erlauben.
7. Schablone nach Anspruch 5, wobei die Vertiefungen Rillen in der Oberfläche des Stegs sind.
8. Schablone nach Anspruch 1, wobei die Löcher in einer regelmäßigen Anordnung von Reihen im wesentlichen parallel zu den Kanten des Bogens angeordnet sind.
9. Erzeugnis, das eine Schablone gemäß einem der vorhergehenden Ansprüche umfaßt.
10. Artikel nach Anspruch 9, bei dem die Schablone auf einen Materialbogen (15) aufgelegt wird,



wobei sich die Ränder der Öffnungen in Kontakt mit dem Materialbogen befinden und die stehenden Gebilde von dort nach oben vorstehen, wobei eine Schicht aus glasfaserverstärktem Kunststoff (16) auf einer offen daliegenden Oberfläche der Schablone aufgebracht wird, so daß sie mit dem Materialbogen durch die Öffnungen in Kontakt kommt und mit diesem verbunden wird.

11. Artikel nach Anspruch 10, mit einem weiteren Materialbogen (17), der mit den nach oben stehenden Bereichen der glasfaserverstärkten Kunststoffschicht verbunden wird.

Revendications

1. Matrice pour supporter une couche de matière plastique durcissable pendant qu'elle durcit en formant des nervures de renforcement creuses adhérant à un article stratifié en matière plastique armée de fibres au cours de la fabrication dudit article, comprenant une feuille perforée (5), la zone de la feuille entre les deux trous de chaque paire de trous voisins étant en relief au-dessus du plan dans lequel se trouvent les bords des trous (6), caractérisée en ce que chaque région en relief comporte une ou plusieurs formations verticales (7) réunies les unes aux autres par un voile flexible (10).
2. Matrice selon la revendication 1, dans laquelle les formations verticales comportent des portées (8) sensiblement planes, parallèles au plan de la feuille.
3. Matrice selon la revendication 2, dans laquelle les formations verticales sont réunies au niveau de leurs bases (9).
4. Matrice selon la revendication 2 ou 3, dans laquelle une ou plusieurs desdites portées sont munies d'une structure de rigidification (11).
5. Matrice selon la revendication 4, dans laquelle ladite structure de rigidification (11) comporte un ou plusieurs creux ou motifs de creux formés dans la surface de ladite portée, lesdits creux étant conçus pour résister à la flexion de la portée transversalement à celle-ci.
6. Matrice selon la revendication 5, dans laquelle lesdits motifs appliqués sur les portées sont symétriques et répétés de façon à permettre l'emboîtement et le chevauchement de feuilles.
7. Matrice selon la revendication 5, dans laquelle les-dits creux sont des gorges dans la surface

de la portée.

8. Matrice selon la revendication 1, dans laquelle lesdits trous sont agencés en un ensemble de rangées sensiblement parallèles aux bords de la feuille.
9. Article manufacturé comportant une matrice selon l'une des revendications précédentes.
10. Article selon la revendication 9, dans lequel la matrice est appliquée sur une feuille (15) d'une matière, les bords des trous étant au contact de ladite feuille de matière et les formations verticales faisant saillie vers le haut depuis celle-ci, une couche de résine synthétique (16) armée de fibres étant appliquée sur une surface découverte de ladite matrice de façon à assurer un contact et une adhésion avec ladite feuille de matière à travers lesdits trous.
11. Article selon la revendication 10, comportant une autre feuille (17) de matière, adhérant à des zones verticales de ladite couche de résine synthétique armée de fibres.